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OLD RIVER CLOSURE - 1981

SUMMARY REPORT
AS REQUESTED BY
WATER OPERATIONS BRANCH
DEPARTMENT OF WATER RESOURCES

1981

D-1485

BIOLOGICAL MONITORING AND ANALYSIS SECTION
CENTRAL DISTRICT

A Memorandum of Understanding was signed on March 10, 1969, by the California Departments of Fish and Game (DFandG) and Water Resources (DWR), the U. S. Bureau of Reclamation (USBR), and the U. S. Bureau of Sports Fisheries and Wildlife (USSFW) following an Interagency report (January 1968) describing interim measures to protect water quality and fishery resources in the Sacramento-San Joaquin Delta prior to construction of a Delta transfer facility.

The combined effect of Federal and State project operations and seasonal low flows in the San Joaquin system were creating flow reversals and low dissolved oxygen problems.

One of the objectives in the Agreement was to minimize the detrimental effects of these adverse conditions in the San Joaquin River near Stockton by installing a control structure at the head of Old River when flows past Vernalis fell below 1300 cfs.

The strategic placement of this control structure effectively forces a greater portion of the San Joaquin River flow downstream past Stockton instead of being diverted down Old River to the export pumps. This flushes out the "pollution-block" that forms in the deeper ship channel and creates a downstream net flow for the homing salmon.

Dissolved oxygen levels of 5.0 mg/L or more are believed to be necessary for fish migrating through the San Joaquin River and into the three major tributaries (Merced, Tuolumne, and Stanislaus Rivers) to spawn.

Placement of the Old River closure and the associated monitoring of water quality conditions in the San Joaquin River during the fall run are part of the effort to restore depleted fall salmon stocks that utilized this region historically.

CLOSURE, 1981

The decision to install a rock barrier across Old River at its juncture with the San Joaquin was made at the annual, summer coordination meeting provided for in the 1969 agreement. This time, however, guidelines for its installation were taken from the pending Two-Agency Fish Agreement between DWR and DFandG. DWR has committed itself to meeting the goals of this Memorandum, although it is still tentative, since it emphasizes the importance of the State Water Project operation in returning fish and wildlife resources to historical levels.

The year 1981 was classified as dry according to the Sacramento Valley Four Basin Index defined in Water Right Decision 1485.

The criteria as specified in the Two-Agency document is to provide a minimum net downstream flow of 500 cfs in the San Joaquin River past Stockton.

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The responsibility for implementing the Old River closure program for 1981 was assigned to the Biological Monitoring and Analysis Section within the Central District. Program management remained with the Division of Operations and Maintenance and funding was transferred to the District.

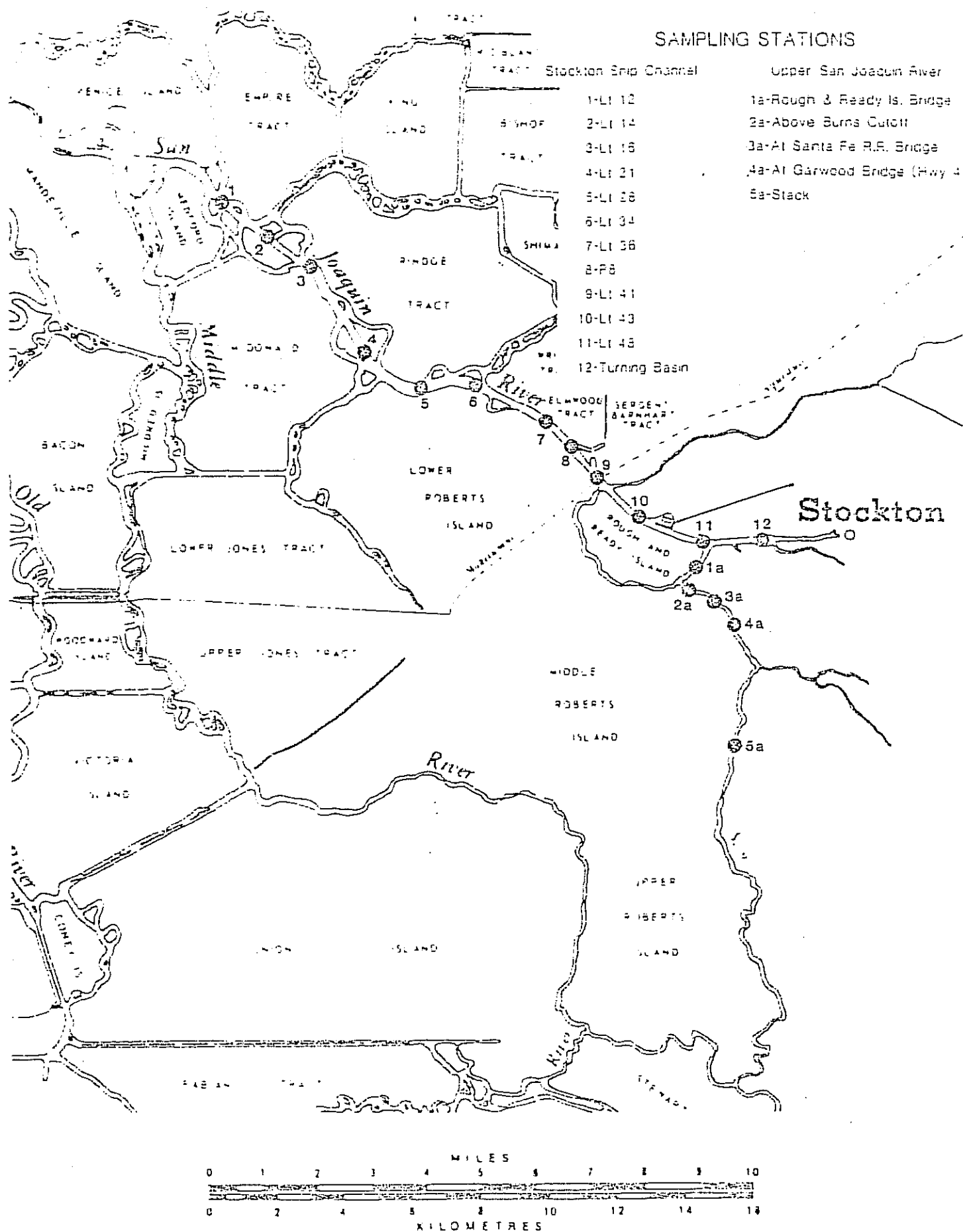
Renewal of access permits to the location site of the closure was assigned to the Division of Land and Right of Way. Supervision of the actual placement and removal of the rock barrier including contractor bids and on-site inspections was conducted by the Division of Design and Construction. District personnel served as task coordinators, distributing Notices of Intent, and performed the necessary water quality monitoring. The closure was completed on October 15, 1981. The Negative Declaration covering this project requires that the closure be removed by November 15. This was in conflict with DFandG's initial request that the closure remain in place until November 30 so late migrants could benefit from the increased net flows. A precedent for resolving this issue was established in 1976 when a similar request was determined to be inconsequential to the project and categorically exempt under Section 15101 of the EIR guidelines. Increasing outflows in the San Joaquin system during November 1981 and improving water quality conditions in the Stockton Ship Channel nullified this need for retaining the control structure and, with concurrence of DFandG, it was removed on November 25, 1981.

MONITORING

A water quality monitoring program was initiated concurrently with construction of the Old River closure to measure the effect of the additional downstream flows on dissolved oxygen levels in the Stockton Ship Channel. This information was periodically reviewed by DFandG to determine if further mitigative measures would be necessary to improve conditions for migrating salmon.

The Biological Monitoring Section normally conducts these water quality surveys. The study area covered in 1981 was from Prisoner's Point on the San Joaquin River to the channel turning basin near Stockton. The R.V. San Carlos was used to collect samples at depths of 1 metre and 1 metre off the bottom at 12 sites during the morning ebb slack tide. Five additional sites on the upper San Joaquin between Rough and Ready Island Bridge and above French Camp Slough were added to assess water quality inflows upstream from Stockton as they enter the dredged ship channel (Figure 1). These sites were monitored by a shallow draft runabout and samples were taken at both ebb and flood slack tides. Discrete measurements on both runs included D.O., pH, E.C., air and water temperature and depth of channel. Continuous parameter profiles were charted aboard the San Carlos for D.O., turbidity, in-vivo chlorophyll, pH, E.C. and water temperature. Percent oxygen saturation was calculated for all discrete water samples. Survey dates were October 9, 23, and November 5 (San Carlos) and October 8 and 23 (runabout). The results of D.O. measurements are shown in Table 1. The October 8 and 9 runs were preclosure surveys which provided a base condition to compare water quality changes resulting from installation of the barrier. At this time, a classic D.O. sag was measured in the ship channel between Lt. 21 and Lt. 43 (Figure 2). The sag actually extended into the turning basin but was interrupted by higher D.O. water entering the channel from the upper San Joaquin at Lt. 48. This caused a noticeable "peak" in the D.O. profile in this section of the ship channel. Dissolved oxygen levels were generally higher in the upper San Joaquin although the area

FIGURE 1



DISSOLVED OXYGEN VALUES (mg/l)

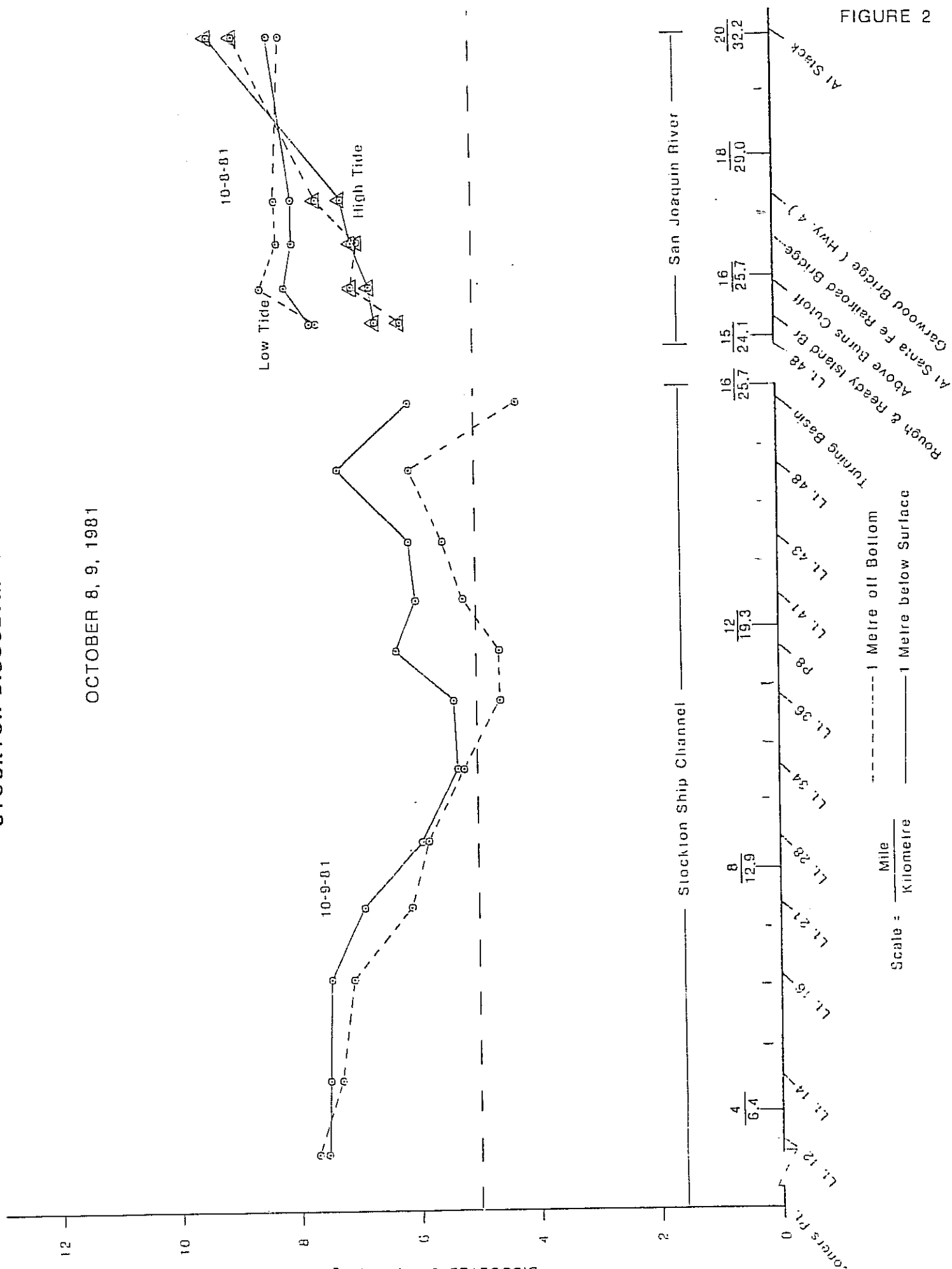
TABLE 1

1981

STATIONS	DATE				
	10-9-81		10-23-81		11-5-81
<u>Stockton Ship Channel</u>					
Lt. 12	7.5 7.7		7.2 7.1		7.5 7.5
Lt. 14	7.5 7.3		7.5 7.1		7.5 7.4
Lt. 16	7.5 7.1		7.2 7.1		7.3 7.3
Lt. 21	6.9 6.1		6.8 7.0		7.1 7.1
Lt. 28	5.9 5.8		7.3 7.4		7.0 7.0
Lt. 34	*5.3 5.2		8.0 7.5		6.9 6.9
Lt. 36	5.4 4.6		8.0 7.5		7.2 7.1
P8	6.3 4.6		8.6 7.4		7.3 7.4
Lt. 41	6.0 5.2		7.8 7.4		7.6 7.0
Lt. 43	6.1 5.5		9.1 7.3		7.9 7.5
Lt. 48	7.3 6.1		8.1 8.1		7.8 7.5
Turning Basin	6.1 4.3		14.0 5.9		8.0 6.5
<u>San Joaquin River</u>	10-8-81				
	Low Tide	High Tide	Low Tide	High Tide	
Rough & Ready Island Bridge	7.7 7.6	6.6 6.2	8.3 8.5	8.3 7.9	
Above Burns Cutoff	8.1 8.5	6.7 7.0	8.5 8.6	10.7 8.2	
At Santa Fe Railroad Bridge	8.0 8.3	7.0 6.9	8.3 8.5	8.5 8.5	
At Garwood Bridge (Highway 4)	8.0 8.3	7.2 7.6	8.5 8.1	8.8 8.5	
At Slack	8.4 8.2	9.4 9.0	8.5 8.3	9.0 8.9	

* Titrated D.O. wrong, value taken from Delta Scientific probe. First

OCTOBER 8, 9, 1981



from the ship channel juncture to Garwood Bridge shows the effect of "sag" water intruding upstream on the high tide.

The first postclosure survey was run on October 23 and revealed a significant improvement in D.O. levels throughout the ship channel (Figure 3). The elevated value in the turning basin was the result of a dense, highly visible algal bloom (described as a "green soup") taking place at that time. This enhanced algal activity results in highly oxygenated water from photosynthetic action. Typically, the bottom D.O. was depressed with a sharp saturation interface occurring at the euphotic zone boundary (extent of available light for photosynthesis). A patch of super-saturated water flowing out of the turning basin apparently intruded up into the San Joaquin River on the flood tide.

The final 1981 run was made on November 5. Only the ship channel sites were monitored and dissolved oxygen levels were all above 6.9 mg/L except for the bottom measurement in the turning basin (Figure 4). This depressed value was probably due to organic material from the earlier algal bloom settling to the bottom creating a biological oxygen demand.

The reverse salinity gradient that is usually formed by the high volume of agricultural waste waters being discharged into the system was typified in the October 23 run (Table 2). The higher E.C. water was transported down the San Joaquin River and after entering the ship channel mixed with lower E.C. waters originating downstream. This

STOCKTON DISSOLVED OXYGEN PROFILE

OCTOBER 23, 1981

914.9

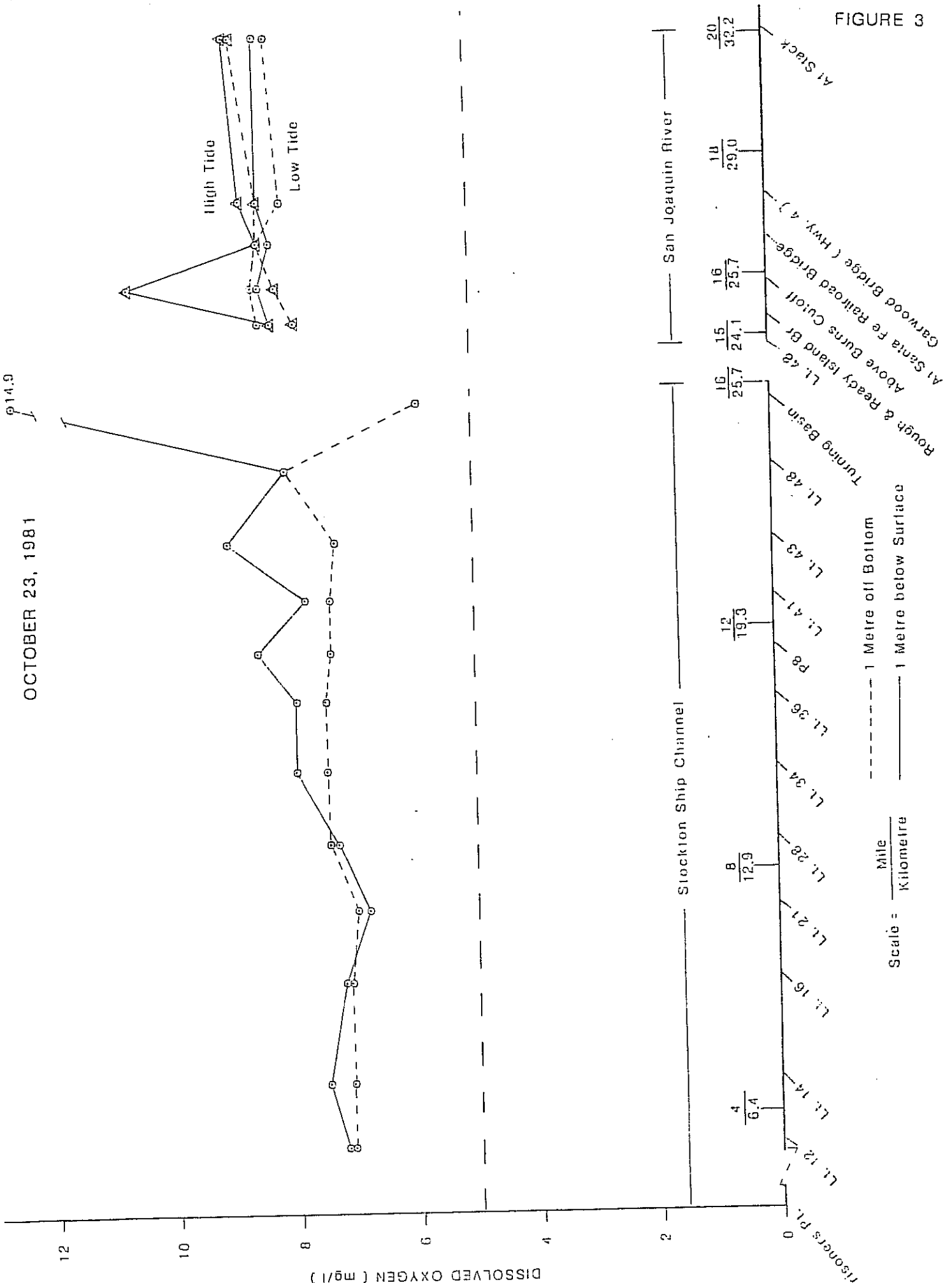


FIGURE 3

STOCKTON DISSOLVED OXYGEN PROFILE

NOVEMBER 5, 1981

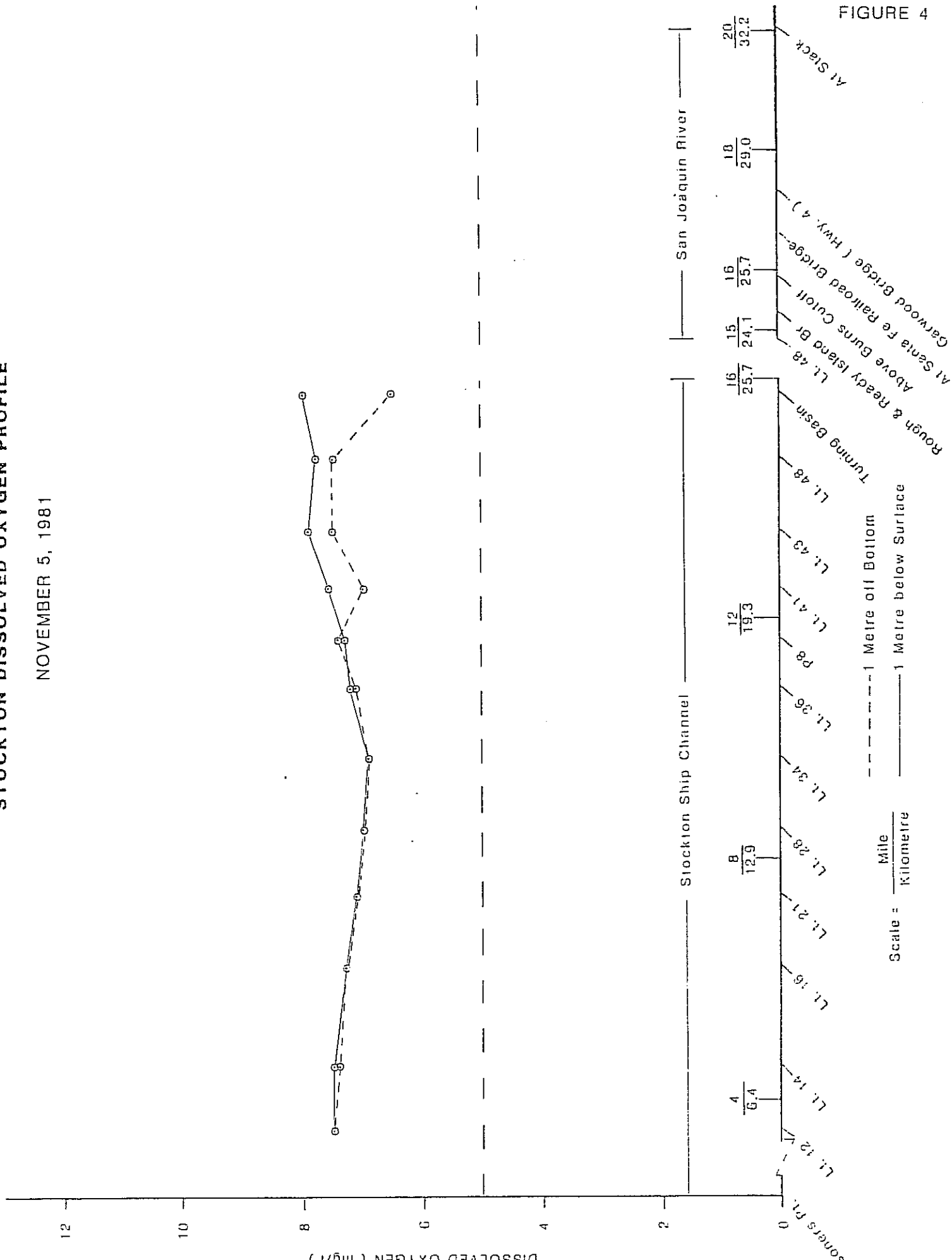


FIGURE 4

TABLE 2

STOCKTON D.O. STUDY
1981 FIELD DATA

STATIONS	10-9-81			10-23-81			11-5-81		
	EC μS/cm	Temperature		EC μS/cm	Temperature		EC μS/cm	Temperature	
		Water °C	Air °C		Water °C	Air °C		Water °C	Air °C
<u>Stockton Ship Channel</u>									
Lt. 12	300	18	18	366	16	14	405	16	11
Lt. 14	342	19	20	444	16	18	575	16	11
Lt. 16	394	19	21	554	16	19	675	16	10
Lt. 21	495	19	21	626	17	19	780	16	11
Lt. 28	592	19	22	631	18	22	805	16	11
Lt. 34	665	19	23	629	17	22	800	16	11
Lt. 36	702	20	24	620	17	23	785	16	11
P8	705	20	23	621	17	24	785	16	11
Lt. 41	705	20	24	629	18	24	790	16	11
Lt. 43	699	20	24	652	18	26	805	16	11
Lt. 48	696	21	26	732	18	27	835	16	11
Turning Basin	775	20	26	642	19	27	800	16	12
<u>San Joaquin River</u>		<u>Low Tide</u>		<u>Low Tide</u>					
		10-8-81							
Rough & Ready Island Br.	555	18	16	829	18	17			
Above Burns Cutoff	538	19	16	870	18	18			
At Santa Fe RR Bridge	577	18	17	848	18	19			
At Garwood Br. (Hwy 4)	520	18	15	820	18	20			
At Slack	615	19	17	917	18	25			
		<u>High Tide</u>		<u>High Tide</u>					
Rough & Ready Island Br.	714	20	25	747	18	27			
Above Burns Cutoff	681	20	25	808	18	23			
At Santa Fe RR Bridge	674	20	25	763	18	26			
At Garwood Br. (Hwy 4)	631	20	24	805	18	23			
At Slack	631	20	24	859	18	25			

mixed water mass which was still relatively high in salt content formed a sharp interface with the Sacramento River and north Delta water moving through the interior Delta to the Project pumps. This interface oscillated between the mouth of Middle River and Turner Cut, depending on the direction of the net flow in the San Joaquin River.

FLOW ENHANCEMENT

The effect of the strategic placement of a closure across Old River on the flow reversal problem at Stockton is evident in the flow-split values. Measurements were taken at the head of Old River and in the San Joaquin above Old River before and after the barrier was in place (Figure 5).

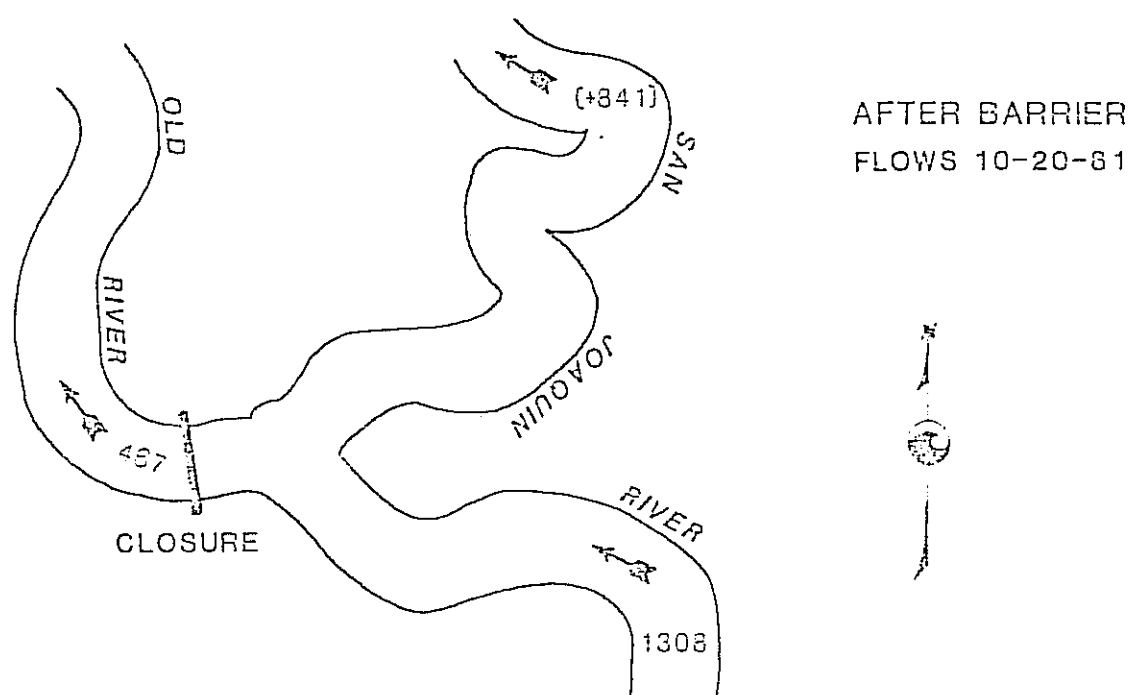
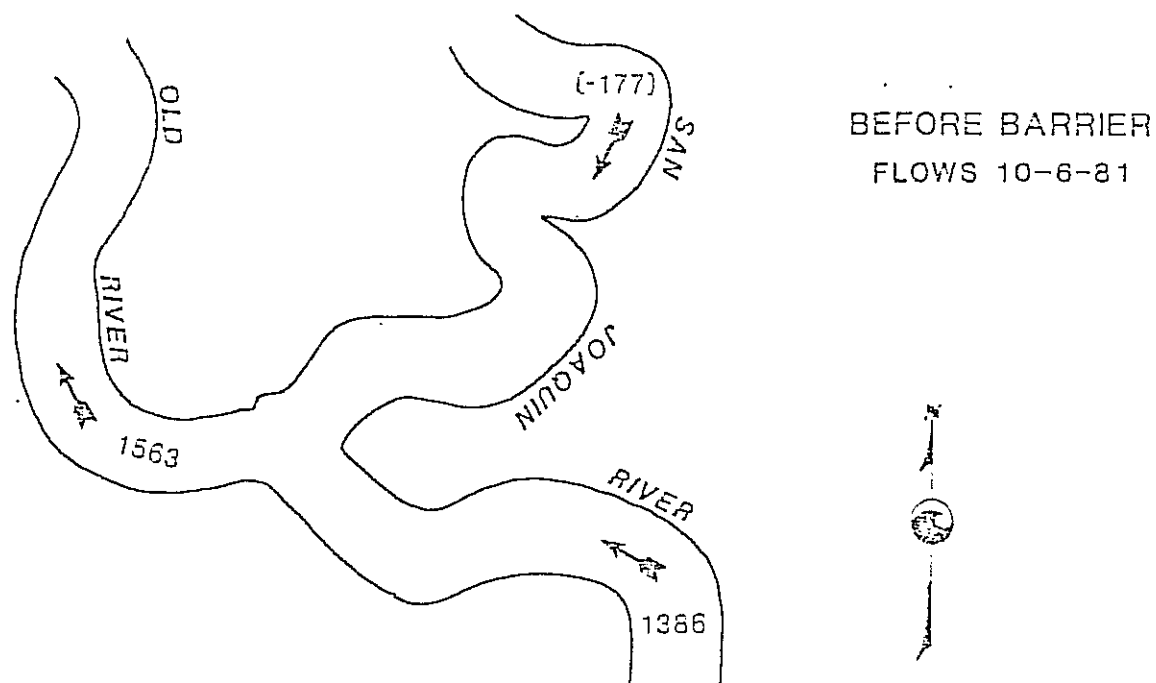
The values shown in the diagram are net flows representing an average of several measurements taken over an eight hour period. The upstream arrow (-177 cfs) depicted in the "before barrier" figure typifies the flow pattern that occurs under conditions of flow reversal.

Although the quantity of flow involved during this period is important, the essential objective is to maintain a net positive downstream flow pattern which provides "homing" water for the migrating salmon.

The change in D.O. and flows in the San Joaquin River before and after placement of the Old River Closure are shown in Figure 6. This illustrates the significant improvement made in flows past Stockton and D.O. by use of the control structure.

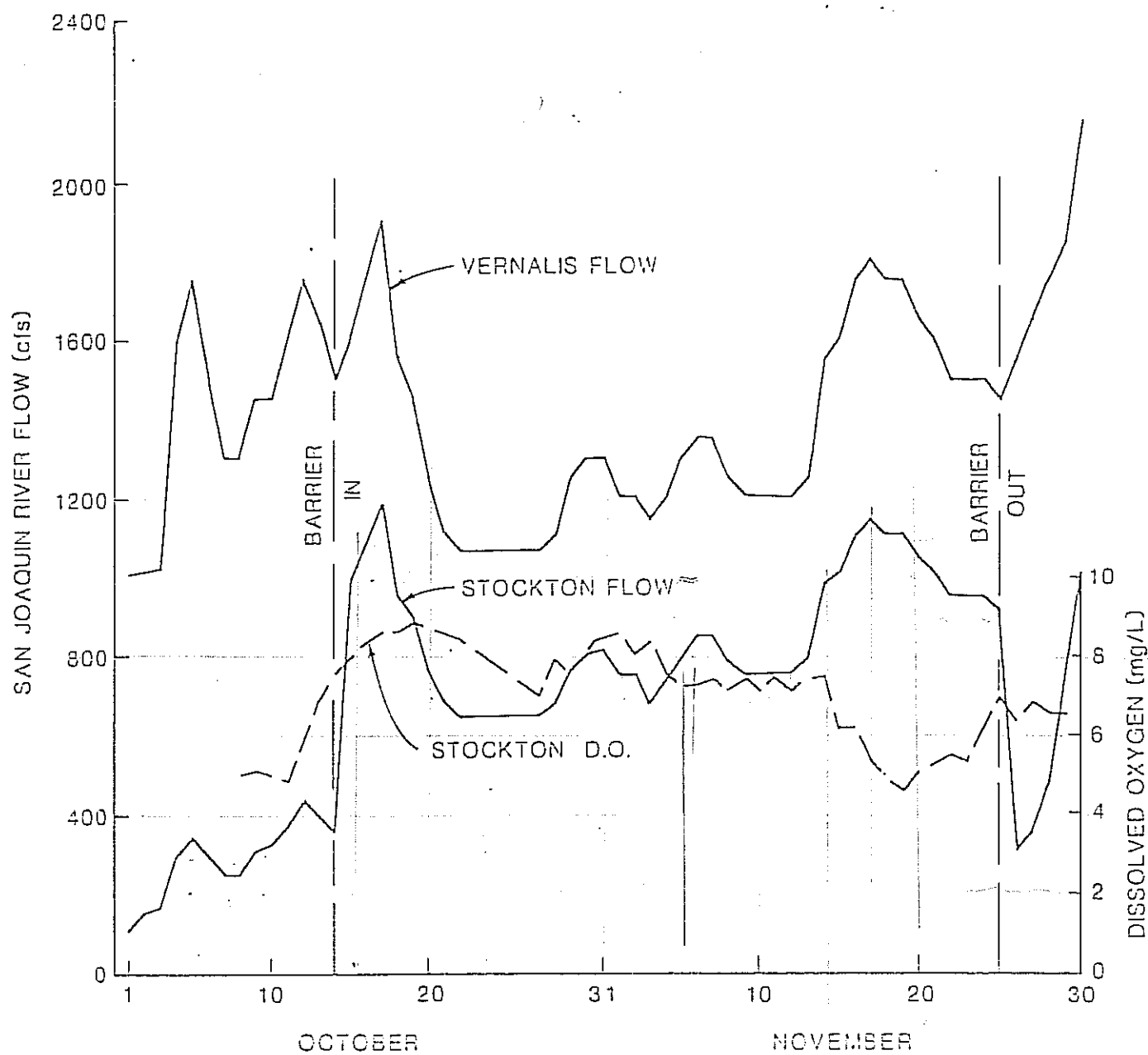
Since the D.O. values measured on November 5 were well above the minimum criteria of 5.0 mg/L, DFandG concurred with our request to suspend further sampling runs and track the D.O. pattern by monitoring the

FLOW SPLITS (cfs) MEASURED IN THE SAN JOAQUIN RIVER
AT MOSSDALE AND AT THE HEAD OF OLD RIVER



STOCKTON DISSOLVED OXYGEN STUDY-1981

FLOW vs D.O.



continuous recorder at Rough and Ready Island. The D.O. levels in the ship channel remained relatively high except for the period between November 17 and 21. The suppressed D.O. pattern that occurred at this time is suspected to have resulted from a combination of factors. An intense rainstorm (1.27 inches of precipitation) occurring just before this period created substantial surface runoff that would contribute to the waste loadings already being carried by the San Joaquin River. This additional oxygen demand in combination with several successive days of fog and cloud cover which would dampen photosynthetic activity were sufficient to cause the depression.

When it was evident that water quality conditions were again improving, DWR requested an advance of the November 30 removal date and with DFandG's approval, the barrier was removed on November 25.

FISH POPULATIONS

The estimates of the number of returning spawners by DFandG for the 1981 fall run (counted from November to December) are listed below:

<u>San Joaquin River System</u>		<u>Mokelumne System</u>
Stanislaus	1,000	(Combined) 5,000
Tuolumne	14,300	
Merced	<u>10,400</u>	
Total	25,700	

The salmon return in 1981 in the Tuolumne River was the largest since 1972, and in the Merced River it was the highest since 1953. The combined total return for the San Joaquin River drainage was 30,700 spawners, the largest number on record since 1971 (Bob Reavis, DFandG, pers. comm.).

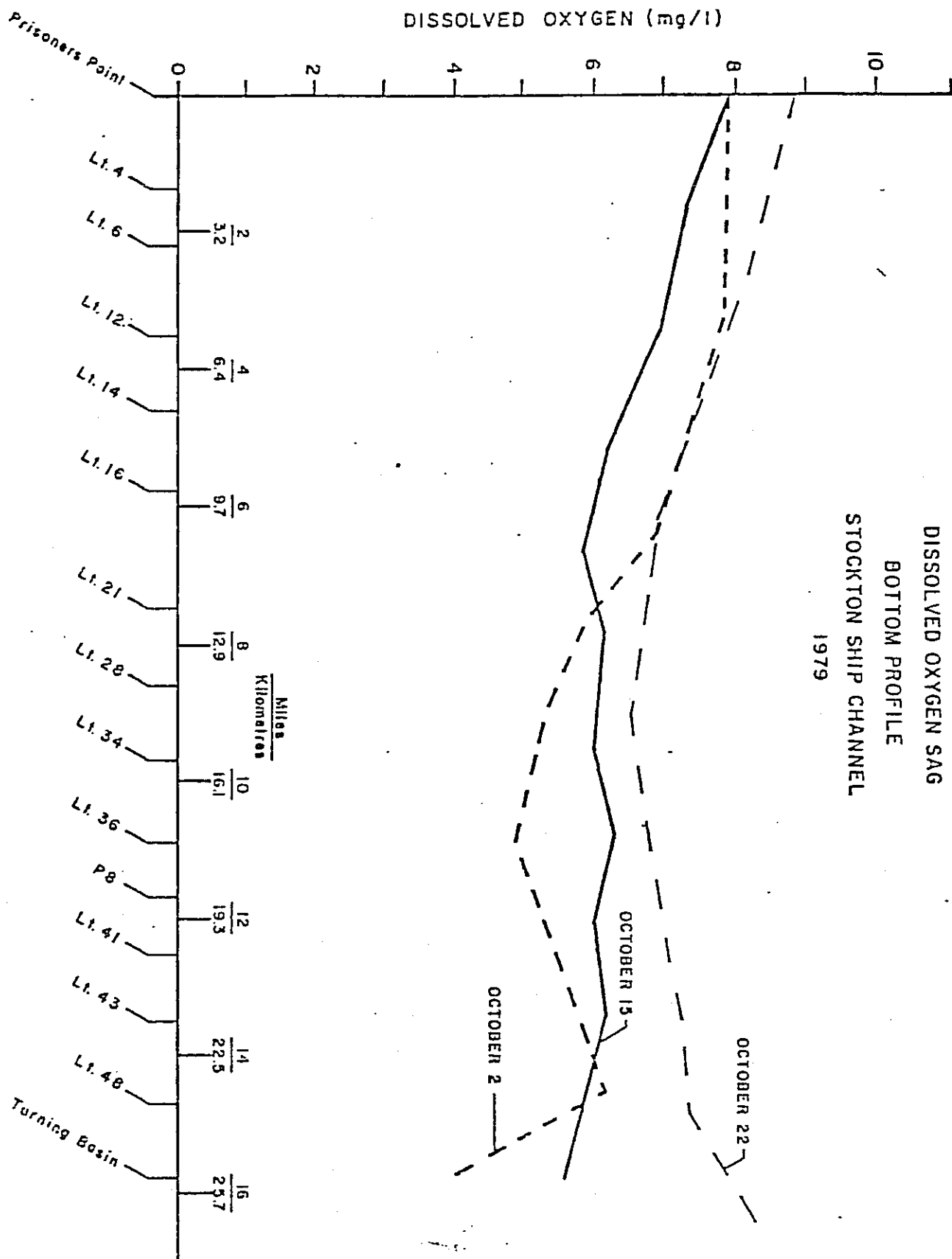


FIGURE 13